

How Good are Energy-Economic Model Forecasts?

Stephen J. DeCanio
Professor of Economics
University of California, Santa Barbara

Backgrounder for Panel Discussion, “Forecasting Our
Energy Future: Why Do We Get Different Answers to
Our Questions on Natural Gas?”

Thursday, July 8, 2004

1:30 – 3:00 pm

2318 Rayburn House Office Building
(House Science Committee, Energy Subcommittee)

Why examine model predictions?

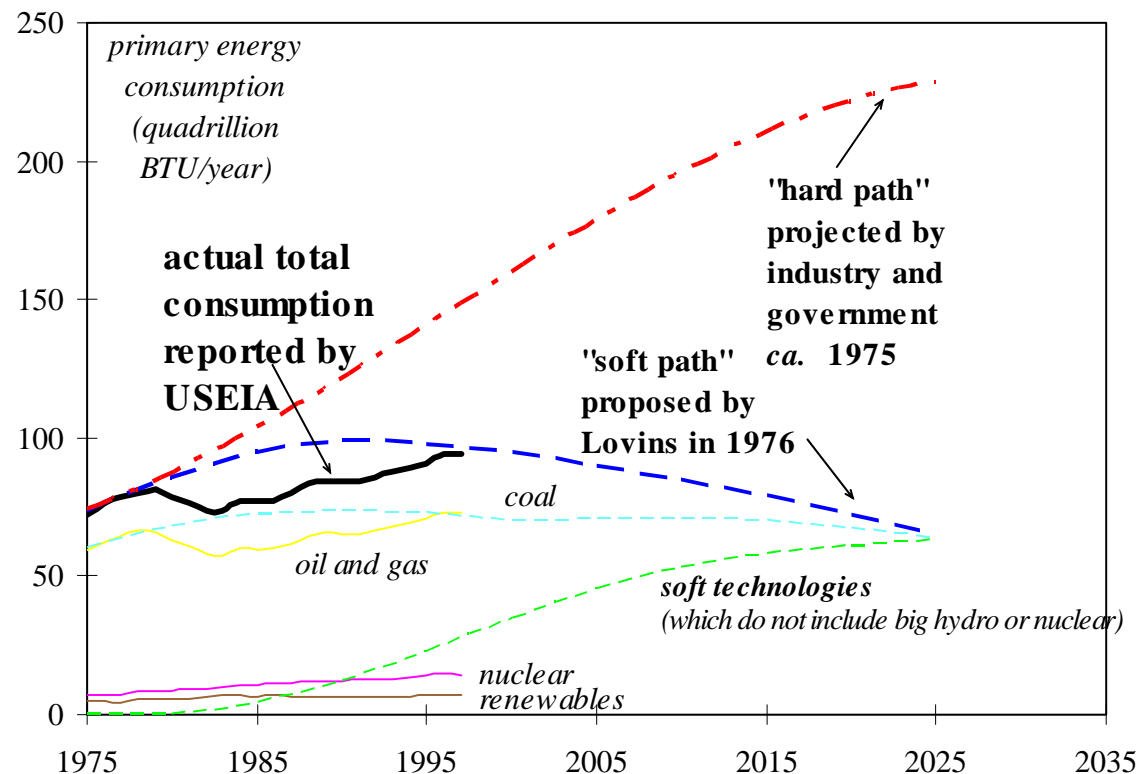
- We spend more on research (by at least a factor of 10) to resolve uncertainties in physical science models than to resolve uncertainties in energy/economic models. Is this the right balance?
- With over 30 years of experience with energy energy/economic models, we have an unusual opportunity to judge their performance.
- Model predictions can influence policy.

Comparing model predictions to actual outcomes

- We should examine the forecasts of models that were “state of the art” at the time the forecasts were made
- Both prices and quantities are important
(and both need to be accurate)
- Have models improved over time?
- What degree of precision should be expected?

Example: Long-term U.S. Energy Forecasts, *circa* 1975

Actual and Forecast U.S. Energy Consumption from Lovins (1976)



Implications for policy

- Current energy-economic models have
very little predictive power
- Models can help evaluate alternative policy choices on a
very “rough” scale
- Cost estimates based on such models (e.g. “costs of Kyoto”) are
far more uncertain than physical science models
- Energy/economic model forecasts should be
viewed with an open mind
- Economic forecasts of regulatory costs tend to be
too pessimistic (see also Krause et al. 2002, 2003)
- *Assumptions matter as much as (or more than) “data”*

Where do we go from here?

- Humility is a virtue
- Assumptions should be as transparent as possible
- Research on modeling foundations would have payoff by increasing policymakers' insight
- What future do we want and how can we get there?

Underlying Assumptions Matter

- Optimization or rule-of-thumb decision-making?
(What is the mathematical form of underlying relationships?)
- Does the model treat technological change as endogenous (calculated by the model) or exogenous (originating from outside)?
- Does the model assume that there are no ways to improve efficiency without reducing performance elsewhere in the economy?
- “Representative” agents or a diversity of consumers/producers?
- Technological diffusion or NPV threshold criterion for investments?

Economic-Environmental “Tradeoffs” Rest More on Model Assumptions than on Evidence

Most Model Assumptions

- All production resources are fully employed and efficiently allocated
- Consumers and firms maximize utility and profits
- Prices perfectly reflect consumer preferences, factor productivities
- Information, adjustment, and transactions costs unimportant
- Income distribution doesn't matter
- Environmental benefits can generally be ignored

Actual Evidence

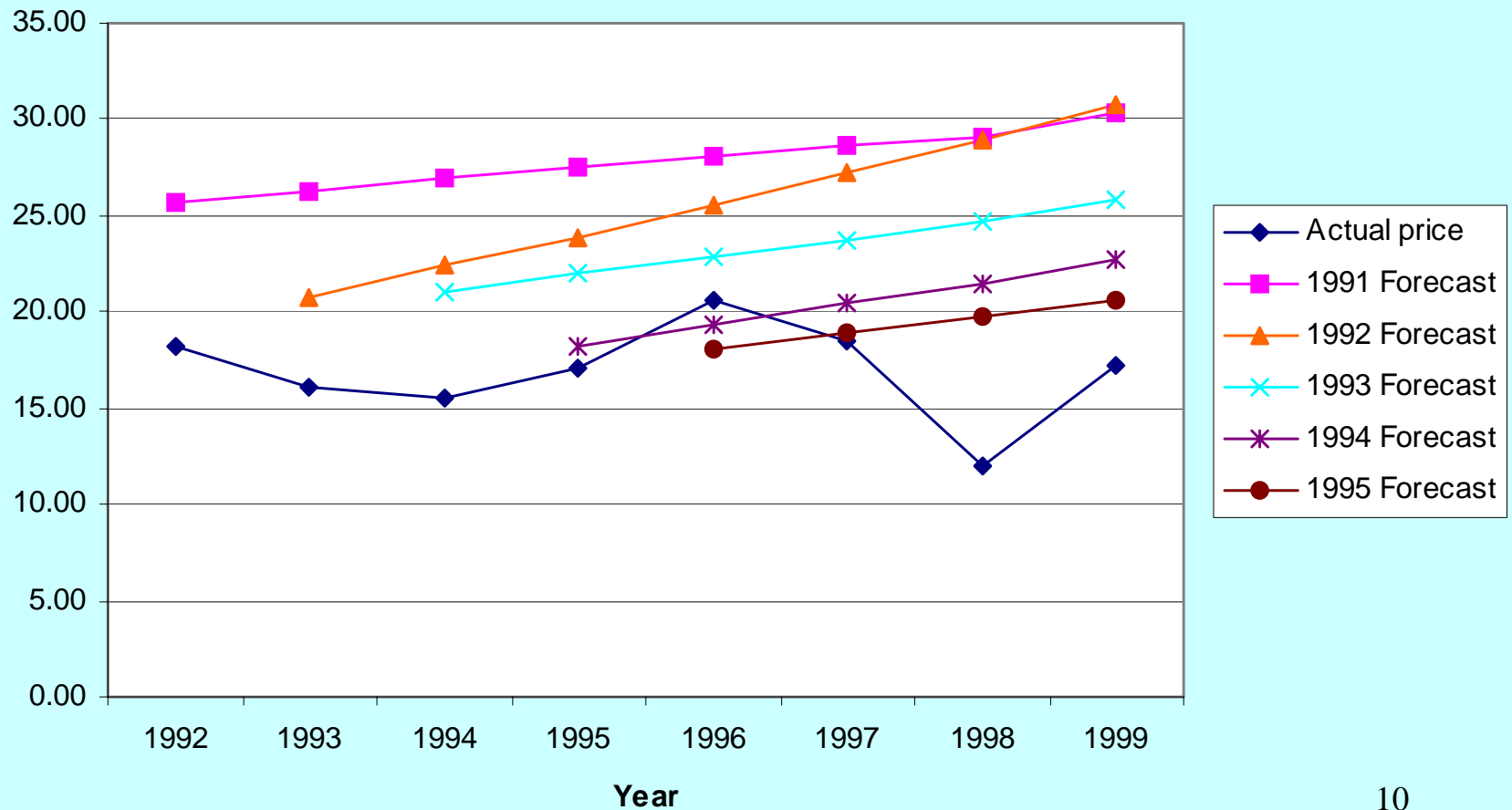
- A 40-year literature shows greater energy efficiency growth than expected
- Firms encounter internal and external barriers to efficiency
- Taxes, regulations, and lack of information distort prices
- Real markets experience frictions and barriers of many types
- “Who gains, who loses” matters
- Externalities can have a large economic impact

Model Predictions are Routinely Wrong

- Quantity – 14 different model predictions from the mid 1970's of energy consumption in the year 2000 overestimated consumption by an average of 44%. (Some were off by nearly 70 %)
- Price – Primary and delivered fuel price estimates have been off by much more – often by as much as 100-300%
- Regulatory Costs – Predictions of regulatory costs tend to be overestimates

Example: Recent NEMS forecasts of Oil Prices

Comparison of Actual and Forecast Oil Prices, 1992-1999



What about Estimates of Regulatory Costs?

- In case studies of regulatory costs (Harrington et al., 2000), ex ante projections were overestimates *three times* as often as they were underestimates, and were inaccurate nearly three times as often as they were accurate (“accuracy” defined as within $\pm 25\%$ of the actual cost)
- *Regulatory costs tend to be overestimated ex ante because of the difficulty of predicting technological and behavioral responses*

Statement on Energy Information for the 21st Century

The record of US model-based energy forecasting and policy analysis yields evidence that such models provide biased estimates that tend to reinforce the status quo, inadequately inform policy-makers about new market potential, and serve to constrain the development of innovative policies.

To address this concern, an informal working group of some 30 modelers and policy analysts attending the ***2003 ACEEE Summer Study on Energy Efficiency in Industry*** drafted a statement for consideration by the larger community of policy analysts interested in energy issues. The intent is to encourage the development of a research agenda that can help advance the state of the art in policy modeling.

To date over 95 energy modelers and policymakers have signed the statement. More information can be found at:

<http://www.aceee.org/energy/manifesto.htm>